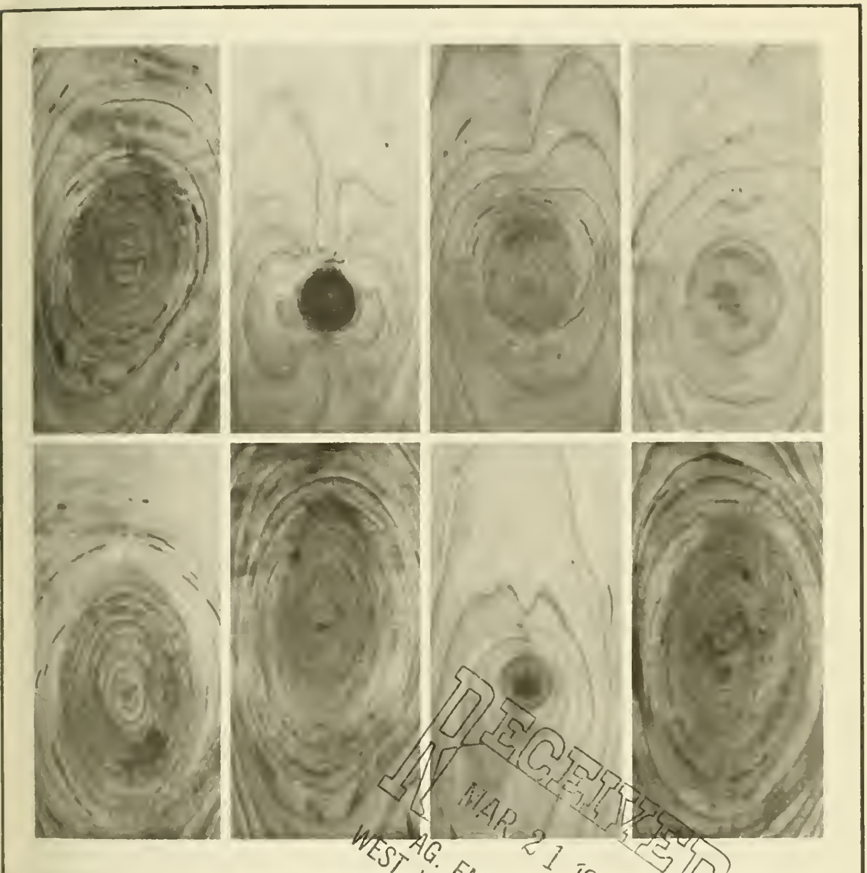
THE RELATIONSHIP BETWEEN CERTAIN EXTERNAL CHARACTERISTICS AND INTERNAL DEFECT IN BLACK CHERRY



Bulletin 615
February 1973

WEST VIRGINIA UNIVERSITY
AGRICULTURAL EXPERIMENT STATION

AUTHORS

Douglas J. Frederick, former graduate assistant in Forestry; Christian B. Koch is Wood Scientist; and Kenneth L. Carvell is Silviculturist.

WEST VIRGINIA UNIVERSITY
AGRICULTURAL EXPERIMENT STATION
COLLEGE OF AGRICULTURE AND FORESTRY
R. S. DUNBAR, JR., DIRECTOR
MORGANTOWN

Summary

A study of the frequency of open and overgrown branch stubs of various s and of black knot cankers was made on the West Virginia University Forest northern West Virginia.

Trees with a greater abundance of branch stubs and a higher percentage of e open and overgrown stubs were found on poor sites. Trees on average and d sites produced fewer large stubs and a greater percentage of small limbs.

Black knot cankers occurred quite infrequently on the first 16-foot log. wever, they were more common on individual branches in the tree crowns.

Twenty-eight bolts containing open knots of various sizes were sawed into -eighth-inch increments which were planed and photographed to show the ent of internal defect. In general, defect associated with large knots appeared in four cuts while defect associated with small and medium knots appeared in two to three cuts.

The Relationship Between Certain External Characteristics and Internal Defect in Black Cherry

Douglas J. Frederick, Christian B. Koch, and Kenneth L. Carvell

IN THE United States, black cherry *(Prunus serotina* Ehrh.) produces wood second only to that of black walnut *(Juglans nigra* L.) for cabinet production. Actually in many parts of the Appalachians and the Northeast, black cherry is more important than walnut because of its greater abundance. Because of the ever-increasing demand for cherry wood, a method of evaluating the quality of standing black cherry trees is needed. Such a method would be helpful in timber marking operations, not only for recognizing the highest quality trees, but also for detecting inferior stems for removal in intermediate cuttings. Identification of trees of high potential value could possibly be made using external stem indicators.

This study was designed to determine the prevalence of two conspicuous external defects of black cherry, open and overgrown branch stubs and bark roughening. The relationship between open knot size and resultant degradation of stem wood was also investigated.

Review of Literature

Little is known concerning the extent of decay associated with open and overgrown knots in black cherry. Previous research on wood quality of cherry has dealt mainly with gum spots, pith fleck and various types of rots.

Campbell and Spaulding (1942) determined that heartwood rots are more prevelant in sprout-origin cherry than in seedling-origin cherry. Stump sprouts are frequently poor in form, susceptible to ice damage and have characteristics which are considered the cause of high sprout-decay hazard in other species. Carvell and Koch (1963), however, observed that good natural pruning of sprout-origin cherry can occur in well-stocked stands and on above-average sites. Natural pruning reduces the high-ascending branches that compete successfully with the main leader, thus discouraging forking and unusually heavy branches. On poorer sites with lower basal area, cherry is not crowded by neighboring stems. Here ascending branches, competing for leadership, are more apt to survive and produce permanent forks.

A dissection study by Campbell (1937) indicated that black cherry is very resistant to decay, and top injuries such as those resulting from glaze cause a low rate of infection. A number of old top injuries were found to have no active decay. The wound parasites which cause most of the top rot in glaze-damaged cherry eventually die as the wounds heal (Campbell and Davidson 1940).

Sleeth (1938) found that sap rot fungi attack the wood only in very large breakage wounds. He found much variability in susceptibility of tree species to sap rot, cherry being one of the most resistant to invasion.

Several publications describe, in a general way, the association between defect indicators and underlying defect (Harrar 1954, Bulgrin 1961, Lockard *et al.* 1963, Ostrander *et al.* 1965, and U. S. Forest Service, Forest Products Laboratory 1966), but none have attempted to relate quality information to measureable tree attributes for use in a quality evaluation system for black cherry. Stayton *et al.* (1968) related external characteristics to internal defect in sugar maple *(Acer saccharum* Marsh.). Interior defect was associated with 80 to 100 per cent of surface rises, bumps, and overgrown sound and unsound limbs. Two-thirds of the overgrown seams and bark distortions had interior defects associated with them. No comparable investigation has been carried out for black cherry. At present, forest managers either do not know how to deduct for cull or do not use universally accepted methods when overgrown branch stubs and localized bark roughening appear on the hole.

In the Northeast, studies of 200 black cherry sawlogs showed that adventitious buds and bud clusters can be disregarded when grading (Hanks 1965). Light and medium bark distortions on all logs and heavy bark distortions on butt logs 15 inches in diameter and larger can be disregarded. However, in the U. S. Forest Service standard grades for hardwood factory lumber logs, which are applied to black cherry as well as other species, most adventitious bud clusters and bark distortions are considered as log-grading defects even though they usually indicate small knots which are no longer considered to be lumber defects (Forest Products Laboratory 1959).

Experimental Procedure

A total of 494 black cherry trees consisting of three nearly equal groups—one from each of three sites, poor (oak site index of 50 or less), medium (oak site index 50-70), and good (oak site index 70 and above)—was sampled to determine the prevalence of dead branch stubs or open knots, overgrown knots and bark roughening resembling black knot on the lower 16 feet of the bole. The trees on each site averaged 33 years of age. Open knots were those with branch stubs exposed and protruding from the bole. Examples are shown in Figures 2, 3, and 4. Overgrown knots are completely covered with stem tissue. Raised knots were characterized by a definite swelling at the knot location; flush knots were identifiable only by bark distortions. Knots were classified according to size as: small, not more than 1 inch in diameter; medium, 1-2 inches in diameter; and large, more than 2 inches in diameter.

For each tree, site classification, d.b.h., height and direction in which the defect faced were recorded. For black knot, the dimensions and per cent of bole coverage at the specific level of occurrence were recorded. Several black knot cankers were dissected for interior examination.

A more detailed examination of five representative trees from each site was ıade to determine the extent of interior defect resulting from open knots of ifferent sizes. The trees were felled, and bolts 2 to 3 feet in length containing ıe defect in question were removed. Twenty-eight bolts were collected ranging om 7 to 15 inches d.b.h. Each bolt was sawed paralled to the pith into 5/8-inch ıick increments by making tangential cuts perpendicular to the axis of the ıcluded branch. It was thus possible to relate defect associated with a particular not to depth within the stem.

esults

This study showed that the frequency of occurrence of both open and vergrown knots were related to site. There were approximately twice as many pen knots and 1.5 times as many overgrown knots per tree on trees grown on oor sites as on those grown on good sites (Table 1). Raised knots occurred on

TABLE 1

The Average Number of Knots Per Tree Classified by Size and Characteristics

	Site		
	Poor	Average	Good
otal Number of Trees	160	170	164
	Average Number of Knots per Tree		
pen Knots	1.8	1.0	.8
Raised	1.4	.7	.6
Flush	.3	.3	.3
vergrown Knots	.6	.4	.4
Raised	.6	.3	.3
Flush	.1	.1	.1
	Average Number of Knots of Different Sizes per Tree		
pen Knots	1.8	1.0	.8
Large	.8	.2	.2
Medium	.3	.2	.3
Small	.7	.6	.4
vergrown Knots	.6	.4	.4
Large	.1	—	.1
Medium	.3	.1	.1
Small	.3	.3	.2

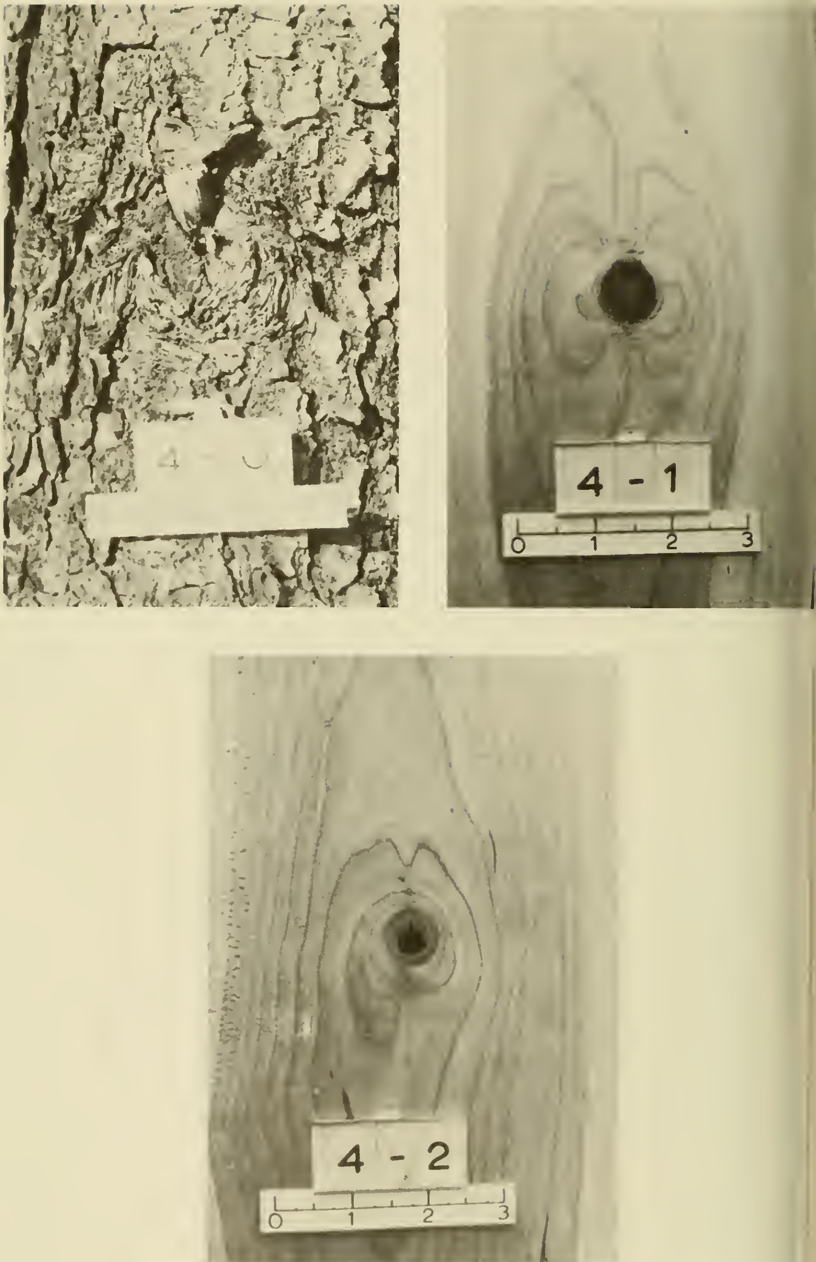


FIGURE 1. A small, open knot. Note bark distortion around the stub. Both the kno nd surrounding wood were sound after removal of the slab.

IGURE 2. A medium, open knot. Wood was sound after the third cut.

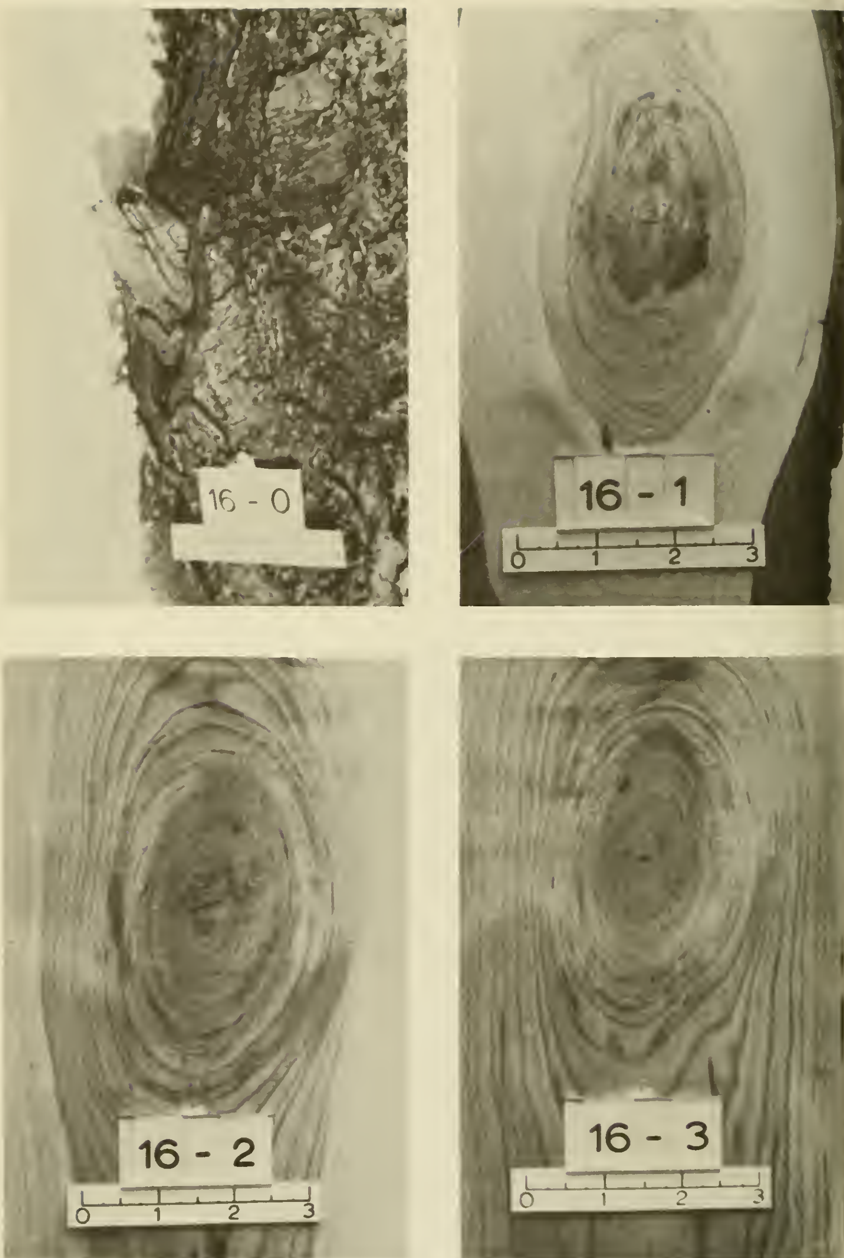


FIGURE 3. A large, open knot. Wood was sound after the third cut.

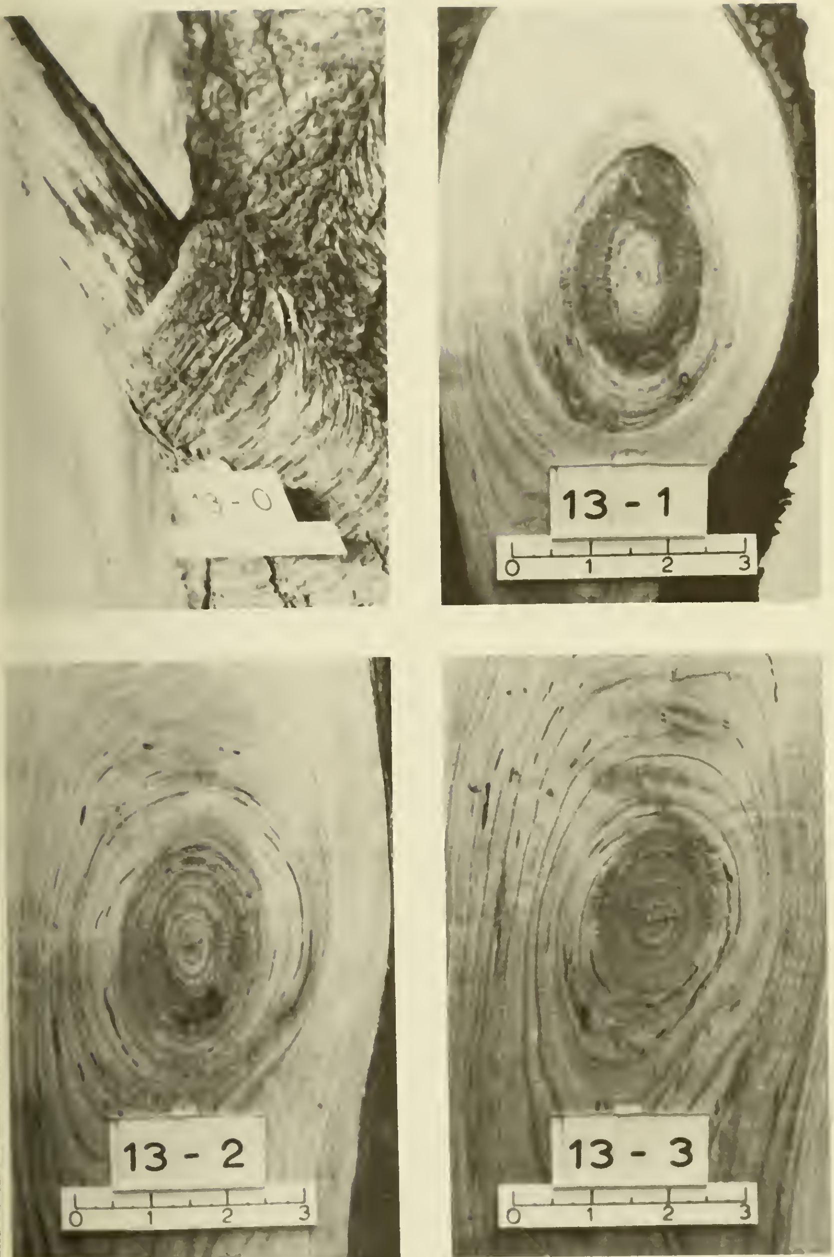


FIGURE 4. A large, open knot. The stub is badly decayed, but the wood is sound after the third cut.

trees from poor sites about five times as often as flush knots. On trees from goc sites, they occurred about twice as often. Considering size class, most of tl knots which occurred in the trees on the poor sites were large. Most of the ope knots in trees on the good sites were small. Most overgrown knots on trees fro all sites were small.

Site had little effect on height of knot occurrence. However, open kno occurred higher on the bole of trees on good sites whereas overgrown kno occurred higher on the boles of trees on average sites. A statistical analysis determine whether knot occurrence was affected by compass direction indicat no significant effect.

Black knot cankers occurred only rarely on the first 16 feet of the bole. (the 494 trees sampled, only 15 had bark roughening resembling black kn cankers. The highest incidence occurred on average sites where seven trees we found with this defect. Only four trees on the poor sites and four trees on tl good sites were similarly affected.

Cankers occurred higher on the bole of trees on average and good sites th on poor sites. The average heights were 13.7 and 13.0 feet respectively, while tl average height of occurrence on poor sites was 9.7 feet. A few cankers attain quite large size, sometimes 1 to 2 feet in length, and encompassed the enti bole. The greatest percentage of bole coverage occurred on average sit however, differences among the three sites were slight. Dissected cankers we found to contain disfigured but sound tissue plus some ingrown bark. T interior woody tissue showed little decay but was of definitely abnormal grow pattern. These cankers formed around old limbs which served as infecti channels to the main stem. It appeared that black knot cankers were mo common high up in the tree crowns. They occurred on individual branch many times encompassing the entire branch.

The sectioning of the 28 bolts exhibiting all the various combinations open knots showed results as summarized in Table 2. In general, the small rais external branch stubs were virtually free of decay. All the examined kn became sound within two 5/8-inch cuts (Figure 1). Small flush branch stu became sound in most cases in two 5/8-inch cuts. Medium raised stubs we considerably decayed, but the knots had become sound in all cases in four five cuts (Figure 2). Medium flush stubs also had some localized decay in t stubs themselves but none in the surrounding heartwood. These also beca sound in four to five cuts. Large raised and large flush stubs had the most dec associated with them, but in both cases the decay was localized in the encas branches and did not spread into the surrounding wood (Figures 3 and 4). l more than five cuts were required to expose solid wood in any of the examp studied.

Discussion

The greatest number and largest knots occurred on trees from the poo sites. This was probably because poor sites support less basal area than bet

TABLE 2

The Number of 5/8-Inch Thick Cuts Made Before Completely Sound Wood Was Encountered

umber of 5/8″ cuts moved before sound ood was encountered	Knot Size: Small Raised	Small Flush	Medium Raised	Medium Flush	Large Raised	Large Flush
	Number of Defects Sampled					
	1	5				
	1	2	4	3	2	2
		1	2	2	1	
				1	1	

es. With less basal area, trees are not crowded, and black cherry, exhibiting pid height growth even on these sites, soon overtops its associates and minates the stand. Accompanying this rapid growth is the tendency for cherry develop large coarse lateral branches. When these branches are shaded and die, ey leave large branch stubs.

Carvell and Koch (1963) found that heavy, even stocking forced good itural pruning and reduced the number of high-ascending branches which mpete with the main leader. High-ascending branches were observed to be ore plentiful on poor sites, probably because of the lighter stocking.

Differences in stand composition on the three site classes probably affected e abundance and condition of branch stubs. On good sites, yellow-poplar *iriodendron tulipifera* L.), northern red oak *(Quercus rubra* L.), and icumbertree *(Magnolia acuminata* L.) compete heavily with cherry. This duces the incidence of large laterals, high-ascending branches, and large reading crowns. On poor sites black cherry has virtually no serious mpetitors, and quickly assumes a position of dominance in the crown canopy.

The average heights of open and overgrown knots varied only slightly tween sites. Possibly with a larger sample, knots would be found to occur gher on the bole on good sites than on poor sites. Knot occurrence showed no rrelation with compass direction.

Black knot cankers occurred on the first 16 feet of the bole on about 3 per nt of the cherry. These cankers were more common on limbs in the crowns. lack knot usually infects limbs and spreads to the bole from these limbs. Since is spreading process is not rapid, many of the branches which were infected hen alive are shaded out and die before infection spreads to the main stem. As e height growth of the trees begins to decline, cankers become more

conspicuous because the crown branches are not being shaded out. This ma
explain why black knot is comparatively rare on the lower portions of the bole
The occurrence of such cankers in the crown is not a serious problem unless the
occur in great numbers. Black knot cankers on the main stem should b
considered defects because they exhibit abnormal growth and are possibl
detrimental to water and food conduction when encompassing a large percentag
of the bole.

On the basis of dissection, branch stubs do not appear to be as serious
defect as was once thought. Decay around branch stubs was confined to the stu
area and did not spread up or down in the heartwood. Nearly all of the deca
associated with small and medium knots and most of the large knots could b
removed with slabs when the logs are sawed.

Pith fleck or gummosis seems to be a more prevelant defect than knots i
black cherry in this geographic area. In all of the study trees, flecking wa
abundant. This would greatly reduce their value not only for veneer but also fo
other uses. Further investigation in this area is needed, specifically to find wh
more flecking occurs on some sites than on others.

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